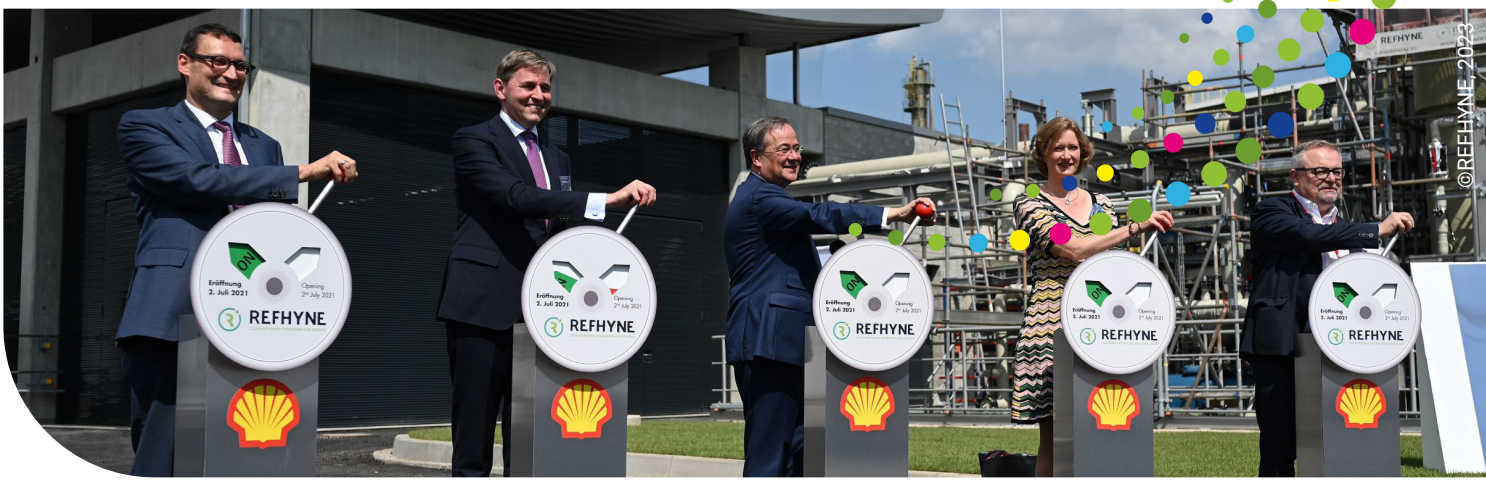
Clean Hydrogen Partnership

Hydrogen Production

Success is stacking up for large-scale electrolysers



Projects funded by the Clean Hydrogen Partnership are developing advanced megawatt-scale electrolysers to meet the standards required for hydrogen production at industrial sites. These electrolysers are used to produce hydrogen on a larger scale using intermittent electricity sources, specifically for industrial purposes and in challenging conditions.

Scaling up production

Green hydrogen production is increasingly recognised as a sustainable solution for various industrial and commercial applications, including steelmaking, chemical processing, transportation and power generation.

Based on their experience, electrolyser manufacturers have improved materials, enhanced performance and increased durability – reducing costs.

Scaling up of these production processes will be the next big challenge, as integration with renewable energy sources requires more sophisticated systems and energy storage solutions.

Project leaders towards clean green hydrogen production

Scaling up the technology has resulted in a 6 MW proton exchange membrane (PEM) electrolysis installation that produced almost 1 000 tonnes of hydrogen over the demonstration period. Thanks to improved dynamic operation characteristics the cost of hydrogen was reduced by 50 %.

The H2FUTURE, DEMO4GRID, REFHYNE and DJEWELS projects focused on developing low-temperature PEM or alkaline electrolysers ranging from 3 MW to 20 MW for a range of industrial applications.

For high temperature solid oxide electrolysers (SOEL), the emphasis was on increasing electrolyser capacity to the MW scale. Projects GRINHY and GRINHY2.0 aimed at improving components and systems, gaining in-depth understanding of fuel stack performance and reducing capital expenditure as well as integrating the systems in a steel production plant.

MULTIPLHY is currently building on the GRINHY2.0 project's results by manufacturing and demonstrating a multi-MW high-temperature electrolyser which will be installed in a bio-refinery in the Netherlands.

SAFETY FOREMOST FOR ALL ELECTROLYSER INSTALLATIONS

Pilot MW-scale electrolyser installations, such as the ones supported by the Clean Hydrogen Partnership, yield crucial safety data for handling more sophisticated electrolyser systems in challenging environments. Deploying electrolysers in industrial plants and integrating them with renewable energy facilities requires innovation, skills and unique engineering to ensure the high level of safety required in industrial courtyards.

BUILDING UPON EXPERIENCE

Ongoing successful projects lead to improved electrolysers, increased safety standards and procedures and allow the familiarisation of industry with the new generation of electrolysers.

The goal? Developing large scale GW electrolysers with lower cost and increased efficiency and durability.
Key results? Successive scaled up projects are proving the technology and physically demonstrating the advances of hydrogen production and its contribution to reaching climate goals.

FIND OUT MORE

https://www.clean-hydrogen.europa.eu/projects-repository_en
https://www.h2future-project.eu/
https://www.demo4grid.eu/
https://www.refhyne.eu/
https://djewels.eu/
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KEY ACHIEVEMENTS

LARGER CAPACITIES
of electrolysers to increase hydrogen production and reduce cost

DYNAMIC OPERATION
demonstrated

DURABILITY
and efficiency tested

SAFETY STANDARDS
and procedures defined

MONITORING
and diagnostic tools developed

REDUCTION IN CAPEX
and operating costs

INTEGRATION
with industrial processes

IMPACT

PROMOTE HYDROGEN USE
in many more sectors.

LOWER footprint in terms of m^2 per MW installed.

TECHNOLOGY
validation opening up new markets for electrolyser OEMs

INTEGRATION
with renewable energy sources such as wind, solar and hydropower, allowing them to penetrate hard to abate sectors and reducing dependence on fossil fuels

GREEN DEAL PROJECTS
with three 100 MW electrolysers

REAL-WORLD PERFORMANCE
validating and demonstrates performance, efficiency and reliability and alignment with climate goals

ELECTROLYSERS UNDER OPERATIONAL CONDITIONS
allowing fine tuning for larger scale deployment and safety procedures

ADVANCING ELECTROLYSER TECHNOLOGY attracts attention to projects aligning with climate goals

Clean Hydrogen Partnership

Co-funded by the European Union

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Clean Hydrogen Partnership

Hydrogen Production

Advances in proton ceramic electrolysers lower costs, increase output

Proton ceramic electrolysers (PCE) opened the way to producing, hot, pressurised dry hydrogen. The Clean Hydrogen Partnership is funding projects focusing on cost-effective PCEs that can play an even bigger role in decarbonising various sectors of industry, advancing Europe's leadership in hydrogen technology.

Game on for PCE development

PCEs offer several potential advantages for steam electrolysis. They are used to produce dry hydrogen directly, which can be used in various applications such as fuel cells for the transport sector and ammonia production. The CHP project GAMER has shown that integration of PCE within a renewable methanol plant using geothermal sources or waste heat or in a refinery environment has potential in terms of gains in efficiency and sustainability.

The electrolysis process operates at intermediate temperature, typically below 650°C, which is beneficial for thermal and material integration with a range of other processes and reduces energy and materials costs. Durability tests show PCEs maintain great stability at 600oC.

The GAMER project has developed an innovative PCE tubular technology for pressurised operation. The project has designed, built and tested tubular repeating cell units (RU) and their assemblies into racks (each made of 16 RU).

A demonstration facility with all balance of plant, rated for 10 kW operation, has also been designed, built and commissioned. PCE can exhibit inherent efficiency improvement when operating in pressurised conditions, as demonstrated on these RUs at up to up to 10 bar.

As the PCEs can operate at elevated temperatures (+600oC), both reaction kinetics and energy efficiency are enhanced during the electrolysis process compared to a low temperature electrolysis process.

Building a clean green future

Based on the GAMER results, the recently funded project PROTOSTACK project aims to develop new compact modular stacks designed to advance PCEs that can operate at a higher pressure of 30 bar. This will improve overall system efficiency with the advantages that are offered by pressurised operation, which were demonstrated during the GAMER project.

Other projects such as WINNER are forging ahead towards optimised electrochemical proton conducting ceramic cells for the production of green hydrogen by ammonia cracking and hydrocarbon dehydrogenation processes as well as reversible steam electrolysis, from small to medium scale.

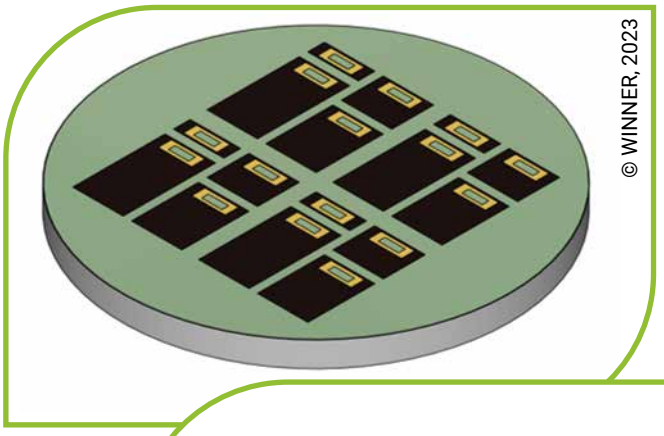
DESIGN CHALLENGES

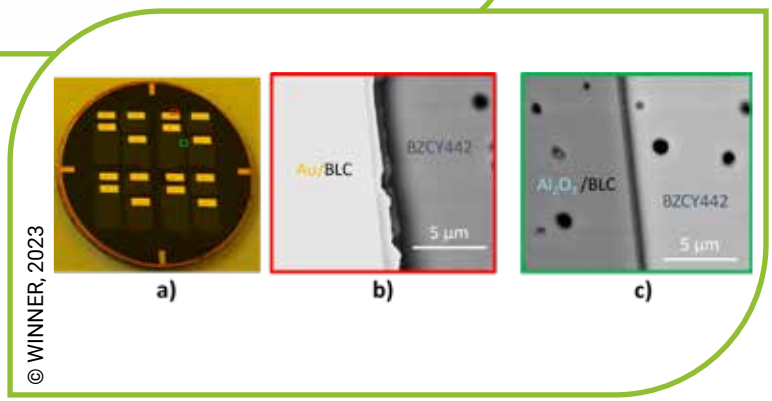
The overall aim of PCE technology development is to prove and upscale hydrogen production efficiently and safely to be commercially viable in the most sustainable way. However, up-scaling remains a challenging task. The durability of components, reducing manufacturing costs and optimising system integration with renewable energy sources, requires radical design and testing.

THE FUTURE OF PCE TECHNOLOGY

The Clean Hydrogen Partnership is funding projects to advance PCE development and scaling up to meet environmental, social, economic and commercial goals.

The goal? Development of efficient, cost effective, green PCE technology scaled to match market needs, with high sustainability and safety, is on the horizon as an important contributor to reaching climate goals.
Key results? Promising lab-scale results are approaching the proof-of-concept demonstration stage, paving the way to the scaling up and commercialisation of PCE technology.





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https://www.clean-hydrogen.europa.eu/projects-repository_en
https://www.sintef.no/projectweb/gamer/
https://www.clean-hydrogen.europa.eu/projects-repository/protostack_en
https://www.clean-hydrogen.europa.eu/projects-repository/winner_en
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KEY ACHIEVEMENTS

NOVEL DESIGN FOR PCE STACKS
based on a tube-in-shell design capable of stable operation at 600oC up to 10 bar for over 500 hours.

NO NI ELECTRODE OXIDATION
unlike cathode oxidation in high temperature electrolysers

HOT PRESSURISED HYDROGEN
produced for direct use:

- Improved efficiency of SEU by increasing pressure up to 10 bar
- Reversible PCE demonstrated at tubular cell level for more than 3000 hours at 4 bar

EFFICIENT THERMO COUPLING
with renewable sources

SUCCESSFUL PROGRESSIVE PROJECTS
encouraging further development of PCE technology

IMPACT

PCE TECHNOLOGY
using efficient large scale hydrogen production

INTEGRATION WITH RENEWABLE ENERGY SOURCES
including waste to energy sources

HIGH TEMPERATURE ELECTROLYSIS
splitting steam into hydrogen and water to produce dry hydrogen

INNOVATIVE ENGINEERING DESIGN
striving for durability, effectiveness and safety

FURTHER RESEARCH OF PCE TECHNOLOGY
with progressive upscaling and diverse resources

COLLABORATION AND AWARENESS
of clean green hydrogen production moving towards climate goals.

Clean Hydrogen Partnership

Co-funded by the European Union

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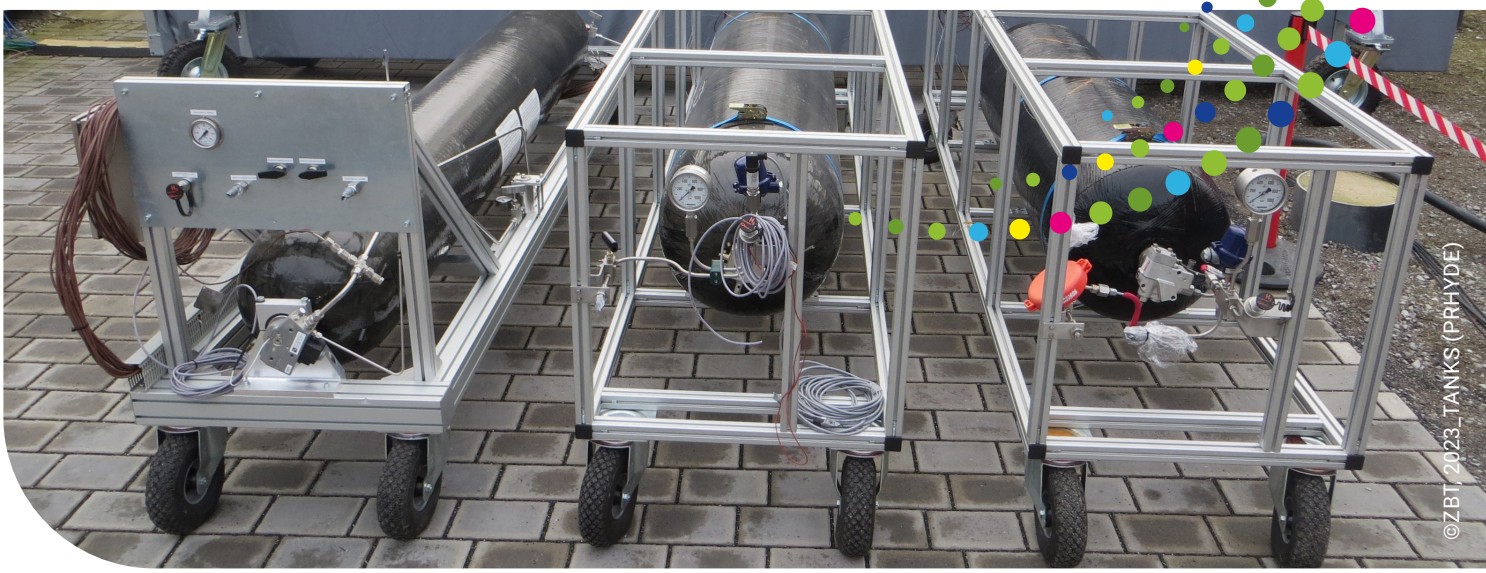
Clean Hydrogen Partnership

Hydrogen Storage and Distribution

Faster hydrogen refuelling of heavy-duty transport



©ZBT_2023_TANKS (PRHYDE)

As part of moves to decarbonise transport, the use of hydrogen to fuel heavy-duty vehicles like lorries, locomotives and ships is set to increase. The Clean Hydrogen Partnership has funded projects that support the development of standards and technologies that will ensure fast, safe refuelling of such vehicles.

New fuelling protocols

Until recently, the deployment of hydrogen technology in transport was focused on vehicles with relatively small tanks. Current refuelling protocols are based on worst-case scenarios related to issues like temperature or pressure increases in fuel tanks due to the limited or absent communication between the hydrogen refuelling stations (HRS) and the vehicles. Although they ensure safety, these protocols do not allow for a sufficiently fast flow rate for lorries.

To speed up flow rates, the PRHYDE project has formulated and validated concepts for new gaseous hydrogen refuelling protocols and submitted them to the International Organization for Standardization (ISO), which establishes the relevant protocols. The relevant ISO committee is in the process of preparing the new protocols using the input provided by the PRHYDE project.

Underpinning hardware development

For implementation, PRHYDE's proposals require improved communication between HRS and the vehicle to provide more information on temperature and pressure during refuelling so that adjustments can be made if necessary. The proposals should underpin the development of such technologies and of new refuelling hardware for heavy-duty vehicles like the high-flow HRS created by the RHEADHY project.

Also necessary for expansion of hydrogen into heavy-duty applications are ways of enabling vehicles, particularly locomotives and ships, to carry larger volumes of fuel. Liquid hydrogen offers a potential solution. The PRESLHY and ELVHYS projects have closed knowledge gaps regarding safe and efficient use of cryogenic technologies for liquid hydrogen fuelling operations.

MAKING TRANSPORT GREENER

The use of hydrogen as fuel can reduce the environmental impact of transport, but for it to be cost-effective for heavy-duty vehicles, refuelling operations must be speeded up.

INCREASED HYDROGEN UPTAKE

The PRHYDE consortium involved entities including HRS suppliers and operators, equipment manufacturers and component suppliers. Some consortium members are members of the ISO committee discussing the protocols and will help to ensure their adoption.

The goal? Adoption of the protocols, combined with development of improved refuelling hardware, will greatly increase uptake of hydrogen solutions for heavy-duty transport.
Key results? Along with the protocol proposals, a report identifying future needs has been compiled and made publicly available.

FIND OUT MORE

https://www.clean-hydrogen.europa.eu/projects-repository_en
https://lbst.de/prhyde/
https://rheadhy.eu/
https://preslhy.eu/
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KEY ACHIEVEMENTS

RECOMMENDATIONS FOR REFUELLING PROTOCOLS
for trucks and other heavy-duty transport systems using hydrogen technologies

REPORT ON FURTHER WORK
needed to transfer the PRHYDE fuelling protocol concepts to standard-setting bodies

HIGH-FLOW HRS
to refuel hydrogen trucks at a rate of 100 kg/10 minutes

INCREASED KNOWLEDGE
of safe use of liquid hydrogen in transport

IMPACTS

FORMULATION OF NEW REFUELLING PROTOCOLS
for heavy-duty vehicles by ISO based on the PRHYDE concepts

APPLICATION OF THE NEW PROTOCOLS
in the transport sector

FASTER, SAFER REFUELLING
of heavy-duty vehicles using gaseous hydrogen

SAFER, MORE EFFICIENT TECHNOLOGIES
for fuelling lorries, ships and trains with liquid hydrogen

INCREASED UPTAKE
of hydrogen as a transport fuel

REDUCED CARBON EMISSIONS
from transport, leading to lower environmental impacts

Clean Hydrogen Partnership

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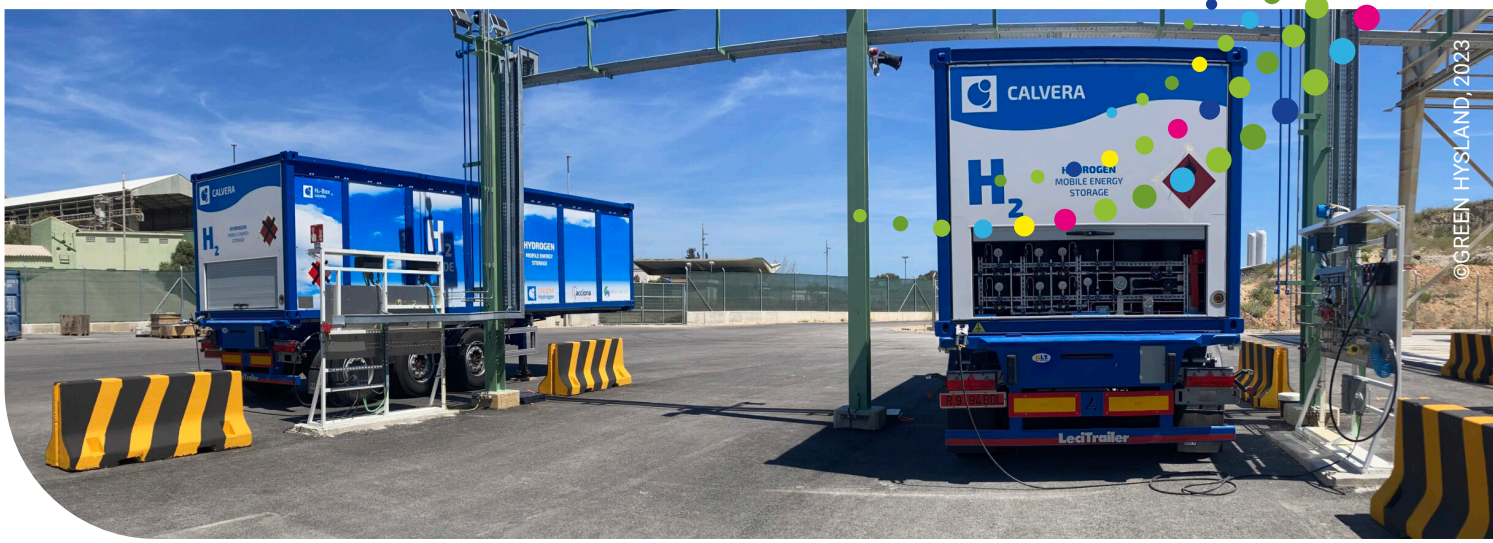
Clean Hydrogen Partnership

Transport End-uses

Hydrogen does the heavy lifting in Europe's ports



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Europe's ports are hubs of industrial activity and economic growth, and therefore major polluters. To help meet the EU's climate change goals, the Clean Hydrogen Partnership is funding the development of zero-emission technology to replace the diesel-powered vehicles that move freight around container terminals and to provide clean power to ships while they are docked.

Reaching for zero emissions

Port logistics operations are energy intensive and contribute to pollution of the surrounding urban and coastal environments. The biggest sources of emissions are the diesel-powered cranes and vehicles used to load and unload cargo, and the large auxiliary power systems used on ships.

The H2Ports project has developed two heavy-duty hydrogen fuel cell vehicles to move cargo in the Port of Valencia, Spain: a reach stacker to stack shipping containers, and a yard tractor with a fuel cell/battery hybrid powertrain. The four-wheel-drive yard tractor loads and unloads cargo, including truck trailers, from ships. A mobile hydrogen refuelling station supplies them with 12 to 30 kg of hydrogen daily. Testing of the yard tractor began in April 2023 and the testing of the reach stacker was scheduled for August 2023, both in demanding conditions.

Separately, Green Hysland plans to install a 100 kW hydrogen fuel cell system in the Port of Palma to supply heat and power for a ferry terminal. Developed by the Everywh2ere consortium, a 100 kW, portable hydrogen-fuelled generator providing power to a rescue vessel while it is docked is expected to be demonstrated in the Port of Tenerife later in 2023.

A first for Europe's ports

H2Ports is the first application of hydrogen technologies in port handling equipment in Europe in real operations. The project will study the best strategy for refuelling of port machinery and other applications. The Port of Valencia already has hydrogen refuelling infrastructure, which makes it perfect for testing potential future uses of fuel cells in ports and the maritime sector.

Data collected over the two years of testing of the vehicles and refuelling station will inform further development of fuel cell technology, as well as maintenance, safety and refuelling protocols.

PROVING THE CASE FOR HYDROGEN

Widespread adoption of hydrogen in ports requires significant infrastructure development. The new vehicles need to match the power and reliability of their diesel counterparts, have comparable refuelling times and contribute to safe and efficient port operations.

CLOSING THE GAP BETWEEN PROTOTYPE AND FINISHED PRODUCT

H2Ports is bridging the gap between prototypes and pre-commercial products. Through its project funding, the Clean Hydrogen Partnership is encouraging manufacturers of heavy-duty industrial equipment to develop zero-emission alternatives. Demonstration in demanding conditions should convince port authorities and logistics operators of their environmental and economic value.

The goal? To show that hydrogen fuel cells are a promising alternative to diesel engines and offer scalability, flexibility and high efficiency, especially when coupled with lithium-ion batteries – as in the case of the H2Ports yard tractor. **Key results?** Port authorities from as far afield as Hong Kong and South Africa have expressed interest in the H2Ports vehicles. The company manufacturing the reach stacker, Hyster Yale, is already receiving orders and intends to scale up production. The yard tractor retrofitting was developed from scratch by Italian research institute Atena. Although it has no plans to commercialise it, the institute is receiving queries from manufacturers and other organisations.

FIND OUT MORE

https://www.clean-hydrogen.europa.eu/projects-repository_en
https://h2ports.eu/
https://greenhysland.eu/
https://www.everywh2ere.eu/
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KEY ACHIEVEMENTS

EUR 4 MILLION
investment in H2Ports

9
commercial, industrial and research partners involved in H2Ports

6 HOURS
of continuous operation by H2Ports yard tractor before refuelling

10-15-MINUTE
refuelling time for the H2Ports reach stacker

15 %
kinetic energy recovery achieved by the hybrid powertrain of the yard tractor

50 M³
buffer tank with capacity for 180 kg of hydrogen developed for the H2Ports refuelling station

IMPACTS

The **PORT OF VALENCIA** is the first in the world to use a hydrogen-powered four-wheel-drive tractor unit.

H2Ports was awarded the title of **BEST RENEWABLE GAS INNOVATION PROJECT** at the Green Gas Mobility Summit 2023. The award recognises transformative and disruptive initiatives in the new renewable and synthetic gaseous fuels value chain.

The Port Authority of Valencia received the **GREEN4SEA 2019 PORT AWARD** for becoming the first port in Europe to use hydrogen to reduce the environmental impact of its operations by supporting H2Ports.

The yard tractor runs efficiently under **CRITICAL OPERATING CONDITIONS**: loading of 30-tonne and 70-tonne trailers onto the upper deck of a vessel.

H2Ports' **FOUR-WHEEL-DRIVE YARD TRACTOR** is the first such hydrogen-powered unit in the world, developed by Italy's Atena research and technology hub.

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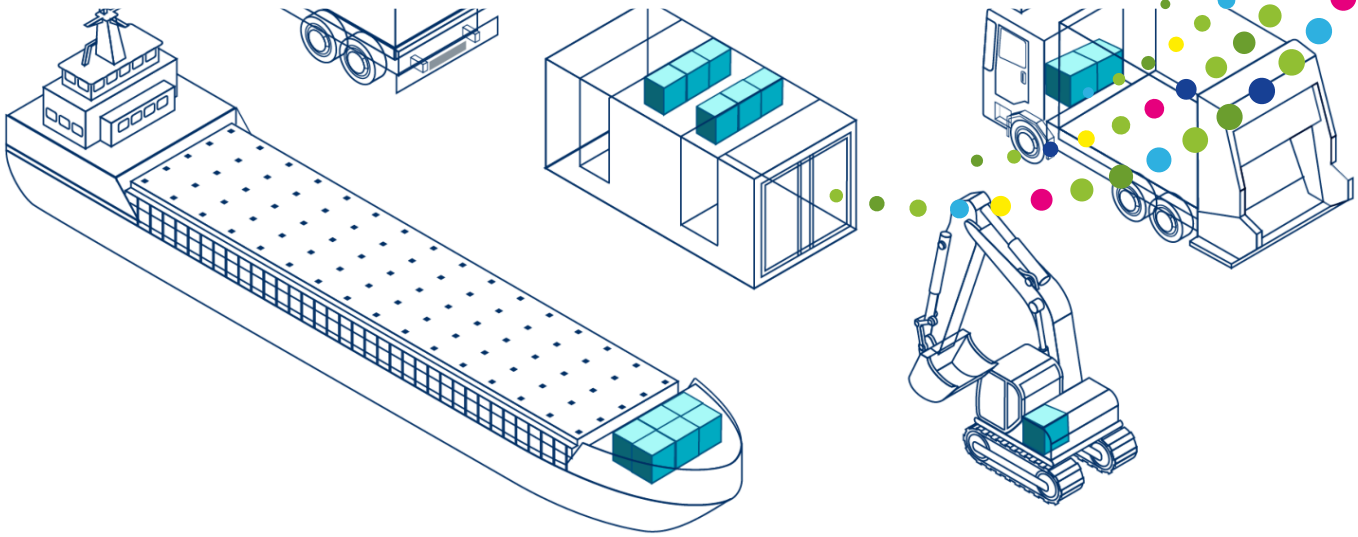
Clean Hydrogen Partnership

Transport End-uses

Standardised fuel cell components for heavy-duty vehicles



Fuel cell and hydrogen technologies are expected to play a key role in decarbonising transport. The standardisation of fuel cell system components is vital for mass production of such technologies at competitive prices. Funded by the Clean Hydrogen Partnership, the STASHH project is standardising fuel cell module for heavy-duty applications.

Setting the standards

The development of fuel cell system components is currently fragmented. Producers work to different designs, requiring vehicle manufacturers to modify their vehicles depending on their fuel cell supplier.

Moreover, differences exist between products for buses, lorries, rail and ships. STASHH addresses this fragmentation by devising standards for fuel cell modules – the boxes containing fuel cell stacks.

The project has formulated initial versions of standards for the dimensions, interconnectors and application programming interface (API) software of modules for heavy-duty transport. The standards ensure scalability so that the modules can be easily adapted for different modes of transport (up to 1 MW).

Making an impact

The standards, which are available at the project website, were agreed upon following discussion involving the entire STASHH consortium, especially fuel cell module and vehicle manufacturers.

Following definition of the standards, the consortium will focus on construction, testing and evaluation of prototype modules. Based on this, the standards will be refined and submitted to international standard-setting bodies.

Another area of focus will be dissemination of the standards to industry. STASHH has already received significant attention from vehicle manufacturers and has worked to maintain contact with all interested companies.

EASIER FUEL CELL ADOPTION

To help decarbonise transport, STASHH has formulated standards for fuel cell modules that will make it easier to adopt fuel cell technology for heavy-duty mobility.

KICK-STARTING FUEL CELL USE

By concentrating on modules, STASHH allows suppliers to continue developing stacks based on their own designs, provided that they comply with the module standards.

The goal? STASHH should kick-start fuel cell use in the heavy-duty mobility sector, reducing its environmental impact.
Key results? The main results are the three documents defining standards for module dimensions, interconnector placement and API software. Another result is a review of rules in various markets and their implications for implementation of the STASHH standards.

FIND OUT MORE

https://www.clean-hydrogen.europa.eu/projects-repository_en
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KEY ACHIEVEMENTS

DIMENSION STANDARDS
for fuel cell modules

FLOW INTERFACE STANDARDS
for air, hydrogen, coolant and power interconnections

DIGITAL INTERFACE STANDARDS
for API control, monitoring and diagnostics software

PROTOCOLS AND WORK PACKAGES
for system testing and safety

OVERVIEW REPORT
on regulations, codes and standards in different markets

IMPACTS

LOWER PRODUCTION
costs of fuel cell systems as a result of easier automation

A STRONGER SUPPLY CHAIN
with increased reliability and availability of parts

A LARGER MARKET
for fuel cell suppliers thanks to a single product for all heavy-duty applications

ABILITY TO SCALE UP
for applications such as passenger ferries

FAIR COMPETITION
among fuel cell suppliers due to ease of switching supplier

LOWER RESEARCH, DEVELOPMENT AND INNOVATION COSTS
for transport sector manufacturers

LOWER COST OF OWNERSHIP
of heavy-duty fuel cell vehicles

INCREASED ACCEPTANCE
of fuel cell technology in the heavy-duty transport sector

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Clean Hydrogen Partnership

Cross cutting

Providing the skills for a European hydrogen industry

With the launch of the European Skills Agenda in 2020 and the European Year of Skills in 2023, the EU has acknowledged the vital role of education and training in providing opportunities to everyone and ensuring sustainable growth. The Clean Hydrogen Partnership is funding several projects that are equipping workers with the skills to build Europe's hydrogen economy and contribute to climate change goals.

A competitive, green economy

The European Skills Agenda is promoting development of the know-how Europe needs to be sustainable and competitive, in line with the European Green Deal objectives. A key element of the Green Deal is the Net Zero Industry Act – a proposed set of measures to strengthen Europe's net zero manufacturing ecosystem.

Given its growth potential, the hydrogen industry can help to achieve the Green Deal goals. For this, a well-trained workforce is crucial. In 2023, the TEACHY2020 and HYRESPONDER projects have continued providing training on hydrogen and fuel cell technologies. TEACHY2020 addresses the supply of undergraduate and postgraduate courses. Building on the HYRESPONSE project, HYRESPONDER trains trainers of emergency responders on hydrogen safety.

Training at various levels

Clean Hydrogen Partnership-funded projects encompass formal education and vocational training for people working in a wide range of sectors, including public officials and technicians. Subjects covered include all the steps of the hydrogen chain, from hydrogen production, storage and distribution, and end uses, alongside key cross-cutting issues such as sustainability or safety aspects.

The partnership will continue to support the development of training programmes and materials and public access to them. It has begun to establish a European Hydrogen Academy and is expanding the education and training module of the Fuel Cells & Hydrogen Observatory.

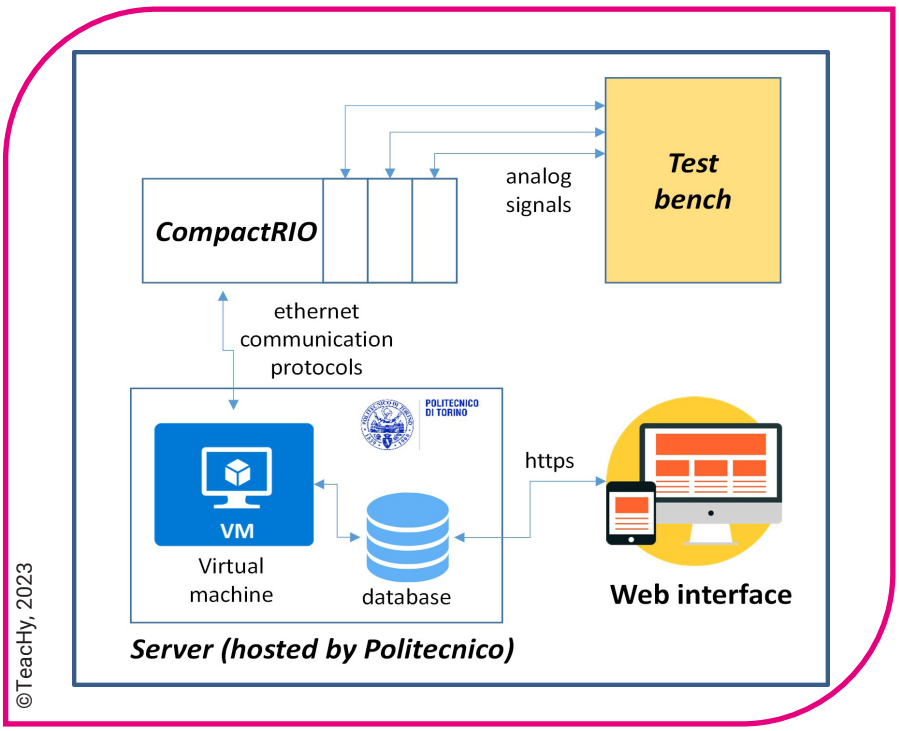
HYDROGEN'S EXPANDING HUGE POTENTIAL

To support commercialisation and greater market uptake of hydrogen fuel cell technology, the industry needs a large, skilled workforce.

VARIOUS PEDAGOGICAL APPROACHES

The projects make use of various approaches, including traditional classroom learning, collaborative and hands-on learning, while incorporating gamification, virtual reality, and e-learning.

The goal? The partnership aims to build on the EU's position as a global leader in hydrogen and fuel cell technology training to provide Europe's hydrogen industry with skilled workers. HYRESPONDER is developing a hydrogen safety training programme for responders, which aims to be recognised as the standard in hydrogen safety training across Europe. **Key results?** Courses and materials for students at different levels and for professionals in several fields.



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KEY ACHIEVEMENTS

15 education and training projects supported by the Clean Hydrogen Partnership

More than **4 500** trainees from across the EU and beyond

An average of **466 hours** of training per course

A **Master of Science programme**, modules to complement existing university courses, continuous professional development schemes and a pan-European university network created by TEACHY2020

A **train-the-trainer programme** in hydrogen safety for emergency responders and a European emergency response guide developed by HYRESPONDER

The **European Hydrogen Academy** – an alliance of educational institutions offering certified training and up-to-date, digitally accessible resources – to be set up

The **Fuel Cell Hydrogen Observatory**, which offers public access to material from 300 training courses, undergoing expansion

IMPACTS

An estimated 5.4 million direct jobs to be created by the European hydrogen industry by 2050

More than 30 million people worldwide in sustainable employment in the hydrogen industry by 2050

A skilled workforce for a strong European hydrogen industry

Reskilling of the existing workforce in declining industries

Safeguarding of expertise in hydrogen and fuel cell technology

Increased acceptance of and confidence in hydrogen technologies

A skilled European hydrogen value chain encompassing a range of new products and serving numerous sectors

Continued EU global leadership in training on hydrogen and fuel cell technologies

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Clean Hydrogen Partnership

H_2 valleys

Hydrogen valleys: building a European clean energy system

The Clean Hydrogen Partnership is funding hydrogen valleys. Covering the entire value chain, they aim to establish regional 'green' ecosystems covering hydrogen production, storage, distribution, and final use. They are the stepping stones to a hydrogen economy that contributes to Europe's green hydrogen economy and energy security.

Creating integrated systems

For hydrogen to be a cost-effective clean energy solution, an integrated system of production and use is needed. BIG HIT, on the Orkney Islands, Scotland, developed a model for how this can be done for heat, power and mobility. HEAVENN is connecting four hydrogen project clusters in the northern Netherlands. The hydrogen ecosystem being developed by GREEN HYSLAND on Mallorca, Spain, will help decarbonise the tourism, transport, industry and energy sectors.

BIG HIT, which ended in April 2022, has shown the value of using hydrogen for energy production and storage on islands. The project created the Hydrogen Territories Platform to share information and methodologies that projects like HEAVENN and GREEN HYSLAND are using to develop their own integrated systems.

Strength in numbers

Building on the work of the Fuel Cell and Hydrogen JU (the predecessor of the Clean Hydrogen Partnership), and working with regions across Europe, the partnership has, since 2014, pursued the initial concept of hydrogen territories, which have evolved into hydrogen valleys. Originated in Europe, the hydrogen valley concept is now being mirrored elsewhere across the globe. Its flagship projects BIG HIT, HEAVENN and GREEN HYSLAND were the first successful projects in this direction.

There are now more than 60 hydrogen valleys at various stages of development in Europe. One of the main goals of the Clean Hydrogen Mission – co-led by the European Commission – is to facilitate the delivery of 100 large-scale integrated hydrogen valleys worldwide by 2030.

To further support these efforts, the European Commission has allocated EUR 200 million to help double the number of hydrogen valleys in Europe.

FROM IDEA TO IMPLEMENTATION: BARRIERS TO HYDROGEN VALLEYS

Successful and viable business cases are necessary for setting up hydrogen valleys. This is subject to attracting public-private financing and securing off-take commitments. Other barriers include successful governance models, regulatory provisions, political support, a qualified workforce and public acceptance.

TAKING THE LONG VIEW

The outcomes of BIG HIT, HEAVENN and GREEN HYSLAND, together with best practices on the Mission Innovation Hydrogen Valley Platform, supported by the JU under Clean Hydrogen Mission, are helping to showcase hydrogen valley flagship projects across Europe, and worldwide. Intended as a platform for project developers, it encourages cooperation and helps to replicate similar concepts elsewhere.

The goal? To demonstrate that integrated hydrogen ecosystems make techno-economic sense. **Key results?** The Clean Hydrogen Partnership has selected nine valleys following its 2022 call for proposals and grants have been signed for most of them. They include two cross-border hydrogen ecosystems: the North Adriatic hydrogen valley and a transnational Baltic Sea valley, each producing at least 5 000 tonnes of hydrogen/year. Seven smaller hydrogen valleys, producing at least 500 tonnes/year each, are based in countries with no or few hydrogen projects: Bulgaria, Greece, Ireland, Italy, Luxembourg, and Turkey. Four additional valleys have been selected under the 2023 call for proposals.

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FIND OUT MORE

https://www.clean-hydrogen.europa.eu/index_en
https://h2v.eu/hydrogen-valleys
https://www.bighit.eu/
https://heavenn.org/heaven-projects/
https://greenhysland.eu/
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Clean Hydrogen Partnership

Clean Hydrogen Partnership

Co-funded by the European Union

KEY ACHIEVEMENTS

26 regions across Europe supported by the Clean Hydrogen Partnership under the **Project Development Assistance I and II** initiative.

EUR 143 million JU funding awarded to 12 new European hydrogen valleys across Europe (with hydrogen production ranging 500 to 5 000 tonnes per year each)

Project level

Models for project governance and delivery developed and implemented

A new-build green hydrogen-powered vessel, the Antonie, is being developed by HEAVENN partners to transport salt between Rotterdam and Delfzijl, replacing 120 trucks per trip.

HEAVENN partner, the Municipality of Hoogeveen, has started building a **hydrogen pipeline network** to heat newly built homes in Nijstad-Oost and connect existing homes in Erflanden .

Main elements of the GREENHYSLAND hydrogen valley have been deployed, including a 2.5 MW electrolyser fed with photovoltaic power, two tube-trailers for hydrogen distribution and 5 hydrogen buses

A replicability tool developed by BIG HIT is being continued in HEAVENN and GREEN HYSLAND to encourage the initiation of Hydrogen Valleys elsewhere

IMPACTS

Additional **EUR 200 million** allocated to the Clean Hydrogen Partnership through the Horizon Europe Programme as part of the RePowerEU plan to accelerate deployment of hydrogen valleys in Europe

More than **60 European regional authorities** in 14 EU countries are involved in the European Hydrogen Valleys Partnership, created in June 2019 to share information, promote investment and develop regional hydrogen policy plans

60 hydrogen valleys are under development in Europe, according to the Mission Innovation Hydrogen Valley Platform

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